PATENT ABSTRACTS OF JAPAN

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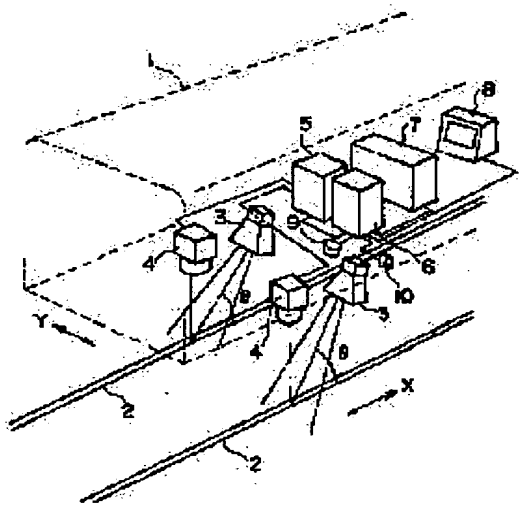
(54) DEVIATION QUANTITY MEASURING DEVICE FOR VEHICLE

(57)Abstract:
PURPOSE: To provide a deviation quantity measuring device of a vehicle capable of measuring the deviation quantity of the vehicle dynamically in the actual traveling state of the vehicle and correctly and easily against the ground side under various vehicle and rail conditions.
CONSTITUTION: Laser beams are projected to rails from laser projectors 3 fitted to a vehicle body 1, reflected beams of the laser beams from the rails 2 are received by sensors 4 fitted on the vehicle body 1 side, the drift quantities in the longitudinal direction and the right and left directions from the reference positions of the reflected beams and the distance between the right and left rails 2 are measured, the displacements in the right and left directions and the vertical direction and the rolling angle of the vehicle body 1 against the rails 2 are obtained, and the deviation quantity of a vehicle is obtained by calculation. The raw data of the sensors 4, the position data of the reflected beams, and the calculated deviation quantity are stored in a memory device 7, the result is displayed on a display 8 on a real-time basis, and the position detection and arithmetic processing can be performed after measurement.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] It is attached in the car body which runs a rail top, and asks for a metrics location, and this metrics location is received. The cross direction of said car body, and the amount of gaps of a longitudinal direction, Based on the amount of gaps of the cross direction from the detection means and this detection means of the non-contact form where the distance between said rails is detected, and a longitudinal direction, and the distance between rails, the amount of displacement and angle of roll of the longitudinal direction to the rail of said car body and the vertical direction are calculated. The amount measuring device of deflections of the car possessing an operation means to calculate the amount of deflections of a car based on this result of an operation.
[Claim 2] with the laser projector which floodlights a laser beam to band-like toward attachment ** and said rail so that a predetermined tilt angle may be made toward this rail into the car body which runs a rail top The detector which is attached in said car body, asks for the criteria location of the reflected light, and detects [the reflected light by said laser beam from said rail is detected, and] the amount of gaps of a cross direction and a longitudinal direction to this criteria location, and measures the distance between said rails, a longitudinal direction [as opposed to the rail of a car body based on the detection value from this detector] -- a variation rate -- an amount and the vertical direction -- a variation rate -- with the treater which asks for an amount and an angle of roll The amount measuring device of deflections of the car possessing the output from this treater, the computing element which calculates the amount of deflections of a car based on the dimension of said car body, and the output means which is for outputting the amount of deflections calculated by this computing element, and consists of either [at least] a storage means or an information means.
[Claim 3] a measuring device according to claim 2 -- setting -- a longitudinal direction and a cross direction -- the amount measuring device of deflections of the car which formed the detector which each became independent, narrowed the visual field before this detector in the direction which needs high degree of accuracy, and prepared the optical lens to which a visual field is expanded in other directions for which precision is not required.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] The amount of flashes to the track of the car which produces this invention by the curve of a track, and transit vibration while a rail car runs: It is related with the amount measuring device of deflections of the car which measures the amount of deflections.
[0002]
[Description of the Prior Art] When having calculated the amount of deflections of a car in approximation with the dimension (vehicle width, vehicle length, distance between centre plates) of a car, and orbital geometric relation and adding an oscillating element to this conventionally, usually asks by count by solving the equation of oscillation of a car.
[0003] Moreover, as an approach of surveying, there is an approach shown, for example in JP,5-5301,A, as an approach of taking vibration into consideration, external force is statically given to a car, and the technique of computing the amount of deflections by measuring the amount of displacement of a car is taken, and when measuring the amount of deflections under transit dynamically, it has measured by installing the supersonic wave or the optical sensor which detects a car in a ground side.
[0004]
[Problem(s) to be Solved by the Invention] When calculating the amount of deflections of the car in consideration of vibration by count, it can solve and ask for an equation of oscillation, but the structure of a car is complicated, and since the oscillation characteristic and track conditions of a car are closely related and become complicated [an equation of oscillation], approximation of suitable modeling etc. is required for vibration of a car again.
[0005] Moreover, it is difficult to search for the oscillation characteristic of a car correctly. From these things, a difference exists with a natural thing between the amount of deflections for which count was therefore asked, and an actual value. Although the purpose which gets to know the amount of deflections of a car has the main purpose which avoids interference with the installation object by the side of the ground etc., when the case where the clearance between the ground side structure and a car cannot fully be taken, and a car carry out big vibration against prediction from the constraint of a location, it will be necessary to get to know the amount of deflections to a precision.
[0006] Then, although the approach of surveying using the dimension of a car and orbital geometric relation at JP,5-5301,A although it is necessary to survey the amount of deflections is offered, the consideration to vibration is not touched on about the approach of it not being carried out, and measuring a variation rate concretely, and calculating the amount of deflections.
[0007] Although it is necessary to estimate the external force to give correctly on the other hand to survey the deflection in consideration of vibration statically, the vibration at the time of actual transit is complicated, and it is difficult to give the external force doubled at the time of transit.
[0008] Moreover, when installing a sensor in a ground side and measuring the amount of deflections, it can measure only in the specific location in which the sensor was installed, but measuring on various kinds of cars and various kinds of track conditions takes huge time and

effort, and it is unreal.
[0009] This invention aims at offering the amount measuring device of deflections of the car which can measure the amount of deflections of a car correctly easily to a ground side in the car of the various kinds in the actual run state of a car dynamic moreover, and track conditions.
[0010]
[Means for Solving the Problem] In order to attain said purpose, in invention corresponding to claim 1 It is attached in the car body which runs a rail top, and asks for a metrics location, and this metrics location is received. The cross direction of said car body, and the amount of gaps of a longitudinal direction, Based on the amount of gaps of the cross direction from the detection means and this detection means of the non-contact form where the distance between said rails is detected, and a longitudinal direction, and the distance between rails, the amount of displacement and angle of roll of the longitudinal direction to the rail of said car body and the vertical direction are calculated. It is the amount measuring device of deflections of the car possessing an operation means to calculate the amount of deflections of a car based on this result of an operation.
[0011] In order to attain said purpose, in invention corresponding to claim 2 with the laser projector which floodlights a laser beam to band-like toward attachment ** and said rail so that a predetermined tilt angle may be made toward this rail into the car body which runs a rail top The detector which is attached in said car body, asks for the criteria location of the reflected light, and detects [the reflected light by said laser beam from said rail is detected, and] the amount of gaps of a cross direction and a longitudinal direction to this criteria location, and measures the distance between said rails, a longitudinal direction [as opposed to the rail of a car body based on the detection value from this detector] -- a variation rate -- an amount and the vertical direction -- a variation rate -- with the treater which asks for an amount and an angle of roll It is for outputting the amount of deflections calculated by the output from this treater, the computing element which calculates the amount of deflections of a car based on the dimension of said car body, and this computing element, and is the amount measuring device of deflections of the car possessing the output means which consists of either [at least] a storage means or an information means.
[0012] invention corresponding to [in order to attain said purpose] claim 3 -- a measuring device according to claim 2 -- setting -- a longitudinal direction and a cross direction -- it is the amount measuring device of deflections of the car which formed the detector which each became independent, narrowed the visual field before this detector in the direction which needs high degree of accuracy, and prepared the optical lens to which a visual field is expanded in other directions for which precision is not required.
[0013]
[Function] According to invention corresponding to claim 1, dynamic moreover, the amount of deflections of a car can be measured correctly easily to a ground side in various kinds of cars and track conditions by the actual run state of a car.
[0014] According to invention corresponding to claim 2, to an operation of invention corresponding to claim 1 the raw data which is the output of a computing element, the location data of the reflected light, the amount of displacement calculated from these, and the amount of deflections in addition, by storing in a storage means The precise amount data of deflections are obtained by carrying out batch processing, after measuring this since detailed analysis of data can be performed after measurement and raw data can be recorded regardless of processing speed. Moreover, by making this storage means memorize the raw data before processing as it is, processing and the operation time are excluded and a sampling period can be shortened more. According to invention corresponding to claim 3, precision and processing speed can improve and the number of detectors can be stopped to the minimum.
[0015]
[Example] Hereafter, the example of this invention is explained using drawing. Drawing 1 is the perspective view showing the outline configuration of the 1st example of this invention, and this is constituted as follows. The laser projector 3 which made the car body 1 correspond to the location of the rail 2 on either side, and only the predetermined include angle theta made the

travelling direction incline, and was arranged, The image pick-up machine or sensor 4 (a sensor is called below) which a car body 1 is made to correspond to the location of the rail 2 on either side, and is arranged, and catches the reflected light of the laser beam from the laser projector 3 in the upper part of a reflective location, The computing element 6 which stores the treater 5 which inputs the detecting signal from a sensor 4 and performs predetermined processing, the dimension data of a car body 1, etc., and generates time data, and performs the operation of the amount of displacement, and the amount of deflections, and generalization of a system, It consists of the store 7 which memorizes the result of an operation, raw data, etc., a display (indicator) 8 which displays the result of an operation and measurement raw data, a gyroscope 9 which detects the acceleration omega of the circumference of the yawing axis of a car body 1, and a speedometer 10 which detects the travel speed V of a car body 1.

[0016] A part of reflected light of the laser beam floodlighted while the rail 2 carried out the travelling direction pair from the laser projector 3 and scanning to the longitudinal direction (the direction of Y) at the predetermined include angle theta is caught by the sensor 4. The detecting signal from this sensor 4 is sent to a treater 5, extracts the reflected light from [from the strength of a detecting signal] a rail 2, and sends the location data of the reflected light from a rail 2 to a computing element 6. It doubles with the dimension data (for example, vehicle dimensions B and H of drawing 5 etc.) of a car body 1 which the amount of displacement calculates and are beforehand inputted from this data in the computing element 6. It judges that it is curvilinear passage from the acceleration of the circumference of the car-body yawing axis measured with the gyroscope 9. The amount of deflections calculates from the radius of curve which can be found from the travel speed V and acceleration omega of the car body 1 measured by the speedometer 10, and while being sent to a store 7 with the generated time data, the result of an operation is expressed as a display 8. Since the raw data measured by the store 7 on the other hand is also memorized, it not only displays and outputs after measuring the result of an operation, but it can carry out batch processing of the raw data.

[0017] By doing in this way, no facility by the side of the ground can be used, the amount of deflections in the condition of could measure the amount of deflections of a car body dynamically, and measurement in the employment condition having been possible on the car, and having suited the actual condition since this system was easily carried in various kinds of cars can be measured, and secular change of the same car can also be measured.

[0018] Moreover, by making data processing into the measurement back and performing batch processing, the sampling period of data can be shortened more and can acquire data to a precision.

[0019] Drawing 2 is the image Fig. showing the laser reflected light location described above, and when a car body 1 is in a criteria location to a rail 2, it makes the location of the reflected light in case there is no deflection the criteria location 11. If a car body 1 rolls, one side of a car body 1 will approach a rail 2, and another side will be left. Since the laser beam is floodlighted with the include angle theta to the rail 2, when a rail is approached, a reflective location shifts back (laser beam incidence side of the direction of X of drawing 1), and when it separates from a rail, a reflective location shifts ahead (direction of X of drawing 1 laser beam reflection-side). Therefore, when a car body 1 rolls, the reflected light shifts to the location of 12 of drawing 2 . By drawing 2 , left-hand side separates from a rail by rolling, and the example in which right-hand side approached the rail is shown.

[0020] Then, difference deltaX1 of the amount of gaps of these right and left And if the right-and-left rail 2 and the distance L between two are found with the location data of the reflected light, angle-of-roll phi can be found as follows. The amount of gaps: deltaX1 The amount deltaZ1 of vertical displacement of a car body 1 The following relation in between is. As shown in drawing 3 , they are deltaZ1 =deltaX1 and tan (theta).

Therefore, phi=tan -1 (deltaZ1 / L)

since -- it can ask. In drawing 3 , in 16, a laser beam and 17 show the reflected light location in a criteria location, and 18 shows the reflected light location at the time of rolling or vertical displacement.

[0021] Moreover, when a car body 1 displaces to a longitudinal direction to a rail 2 (in the case

of horizontal movement), a reflected light location shifts to a longitudinal direction (the direction of drawing 1 Y), and turns into a location of 13 of drawing 2 . The amount deltaY1 of gaps from the criteria location of this reflected light location It can be found from location data and is this amount deltaY1 of gaps. It becomes the amount of displacement of the longitudinal direction to the rail 2 of a car body 1.
[0022] Moreover, like [when a car body 1 displaces in the vertical direction to a rail 2 (in the case of vertical movement)] the case of rolling, in this case, right and left shift in the same direction, and a laser reflected light location is the amount deltaX2 of gaps, however it shifts to a cross direction. It is right and left, becomes equal, and becomes the location of 14 of drawing 2 . this amount deltaX2 of gaps from -- as follows -- the upper and lower sides -- a variation rate -- amount:deltaZ2 It can be found.
[0023] deltaZ2 =deltaX2 and tan (theta)
The variation rate to the rail 2 of a car body 1 has happened, where the upper and lower sides, right and left, and rolling are compounded (compound agitation). Therefore, the reflected light location of laser usually turns into a location shown in 15 of drawing 2 . In this case, each amount of displacement is calculated as follows. The amount of cross-direction gaps on either side is deltaX3 and deltaX4. Asking, the amount of vertical displacement is deltaZ3. deltaZ3 = (deltaX3+deltaX4) (/2-deltaX3), tan (theta)
Moreover, for an angle of roll, phi is phi=atan (deltaX3+deltaX4) (/L).
Moreover, the amount of right-and-left displacement is deltaY2. It becomes the amount of displacement as it is.
[0024] thus, the upper and lower sides to the rail 2 of a car body 1 and right and left -- a variation rate -- if an amount and an angle of roll are called for, and the dimension data of a car body 1 are beforehand inputted into the computing element 8, as shown in drawing 4 and drawing 5 , amount of deflections deltaH of a car will be called for by the geometric operation.
[0025] cos(phi)+H-sin(phi)+deltaY-B [deltaH=B/2, and]/2 -- although it is only the deflection by the upper and lower sides of a car, right and left, and rolling agitation (vibration) which was shown here, there is yawing in movement of the car which should be taken into consideration about a deflection. this -- receiving -- a variation rate -- measurement of an amount is shown in drawing 6 -- as -- car-body 1 order -- 2 place 19 -- carrying out -- each right and left -- amount of deflections deltaHy of the car can know the yawing angle phi from the difference of a variation rate, and according to this Calculating is possible. (Refer to drawing 6)
Phi=atan (deltaY21+deltaY22) (/Lx) / 2deltaHy =Lo / 2, tan (phi)
Furthermore, although it is observed as an amount of displacement of a longitudinal direction when [this] a car arises also by curvilinear passage, as the deflection of a car is shown in drawing 7 If the acceleration omega of the circumference of the yawing axis of a car is measured and the rate V of a car body is measured with a speedometer 10 with the gyroscope 9 attached in the car body in order to distinguish from the variation rate by horizontal movement With the dimension data of a car body 1 which a radius of curve r can be found and are beforehand inputted into the computing element as this, this amount of deflections:deltaHr1 and deltaHr2 can be calculated.
[0026] R=V/omegadeltaHr 1=(r2-(L/2) 2)1/2-(r2-(l+L/2) 2)1/2deltaHr2=r-(r2-(L/2) 2) 1/2, thus the calculated amount of deflections can be checked on a display 8. Since coincidence memorizes also at storage 7, it can output by after [measurement] regeneration, a printer, etc.
[0027] According to the 1st example described above, the following effectiveness is acquired. Moreover, the amount of deflections of a car can be dynamically measured only by the device carried in the car-body 1 side. Since all loading devices can carry in a car-body 1 side easily, the amount of deflections can measure correctly in the state of real employment to various kinds of track conditions of various kinds of cars.
[0028] Moreover, since it can carry in various kinds of cars, secular change of a car can also be grasped. Furthermore, since the raw data of sensor 4 signal, the location data of the reflected light, the amount of displacement calculated from these, and the amount of deflections are stored in a store 7, detailed analysis of data can be performed after measurement and raw data can be recorded regardless of processing speed, the precise amount data of deflections are

obtained by carrying out batch processing, after measuring this.
[0029] Moreover, by storing the raw data before processing in this storage 7 as it is, processing and the operation time are excluded and a sampling period can be shortened more. Drawing 7 is drawing showing only the important section of the 2nd example, and is the example which installed the optical lens 22 which expands only the visual field of a longitudinal direction (drawing 1 and the direction of Y of drawing 8) in front of a sensor 4 in the example of drawing 1 .
[0030] Drawing 9 is drawing showing only the important section of the 3rd example, and is the example which installed the optical lens 24 which uses a sensor 4 as the sensors 23, such as 1-dimensional CCD, in the example of drawing 1 , and expands only the visual field of a cross direction (drawing 1 and the direction of X of drawing 9) to the front face of a sensor 23. .
[0031] in order to take out the effectiveness of this invention, it is shown in drawing 1 -- as -- each right and left -- if there are the laser projector 3 and sensor 4 of a pair, the image of a reflected light location as shown in drawing 2 will be acquired. However, although it is necessary to take a large visual field in order to cover the range of fluctuation of a reflected light location, location precision receives constraint in the number of pixels of an image pick-up machine or a sensor. It is possible to increase the number of an image pick-up machine or sensors in order to improve precision, covering the range of fluctuation of the reflected light as one approach for escaping this constraint. However, by this approach, the number of sensors increases, and since it is necessary to compound the image pick-up machine of about [that it becomes difficult to carry in various kinds of cars which are one description of this invention easily], or a large number, or the data of a sensor, processing speed will become slow. Since the range of fluctuation of a reflected light location is large in the direction of Y and it is comparatively small in the direction of X, as precision is secured in the direction of X, expanding a visual field in the direction of Y with an optical lens 22 so that the reflected light may not separate from a visual field like drawing 8 , the reflected light location of the direction of X is detected. And only the direction of X attaches the optical lens 24 to which a visual field is expanded, and detects the reflected light location of the direction of Y so that the reflected light may not separate from a visual field ahead [the] using sensors, such as 1-dimensional CCD of a large visual field, to the direction of Y like drawing 8 . Thus, since the number of sensors can be managed with the minimum, and composition of an image also becomes unnecessary and each sensor performs location detection independently, raising precision by using the image pick-up machine or sensor which became independent in the direction of X, and the direction of Y, location detection processing can carry out at high speed.
[0032] Moreover, the sensor 4 of drawing 8 is selected judging from the visual field which must cover precision, and 1-dimensional CCD sensors, such as a two-dimensional CCD camera, etc. may be selected according to it. Moreover, it is possible to also use the sensor of drawing 9 as a two-dimensional CCD camera due to precision and a visual field. Even when using a two-dimensional CCD camera, location detection is performed for the direction of X only about either among the directions of Y, it only supposes that putting into a visual field is, and the processing time is accelerated so that this detection may not be spoiled to the other directions.
[0033] According to the 2nd and 3rd example described above, the following effectiveness is acquired. Since the number of sensors 4 can be made into necessary minimum since optical lenses 22 and 24 perform expansion of a visual field, and contraction alternatively, dividing the amount of displacement to the rail 2 of the car body 1 required for count of the amount of deflections of a car in the direction of X, and the direction of Y, and securing the visual field of each direction, respectively so that precision may be raised, and location measurement performs independently in X and the direction of Y again, processing becomes easy and compaction of the processing time is aimed at.
[0034] Although the image pick-up machine or the sensor 4 raised with the above-mentioned example what inputted the reflected light of the laser beam from the laser projector 3, if it is the measurement means of the non-contact form where the electromagnetic wave, the field, the supersonic wave, etc. were used instead of the laser beam, it is good anything.
[0035]

[Effect of the Invention] According to this invention, the amount measuring device of deflections of the car which can measure the amount of deflections of a car correctly easily to a ground side in the car of the various kinds in the actual run state of a car dynamic moreover and track conditions can be offered.

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TECHNICAL FIELD

[Industrial Application] The amount of flashes to the track of the car which produces this invention by the curve of a track, and transit vibration while a rail car runs: It is related with the amount measuring device of deflections of the car which measures the amount of deflections.

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PRIOR ART

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[0003] Moreover, as an approach of surveying, there is an approach shown, for example in JP,5-5301,A, as an approach of taking vibration into consideration, external force is statically given to a car, and the technique of computing the amount of deflections by measuring the amount of displacement of a car is taken, and when measuring the amount of deflections under transit dynamically, it has measured by installing the supersonic wave or the optical sensor which detects a car in a ground side.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the amount measuring device of deflections of the car which can measure the amount of deflections of a car correctly easily to a ground side in the car of the various kinds in the actual run state of a car dynamic moreover and track conditions can be offered.

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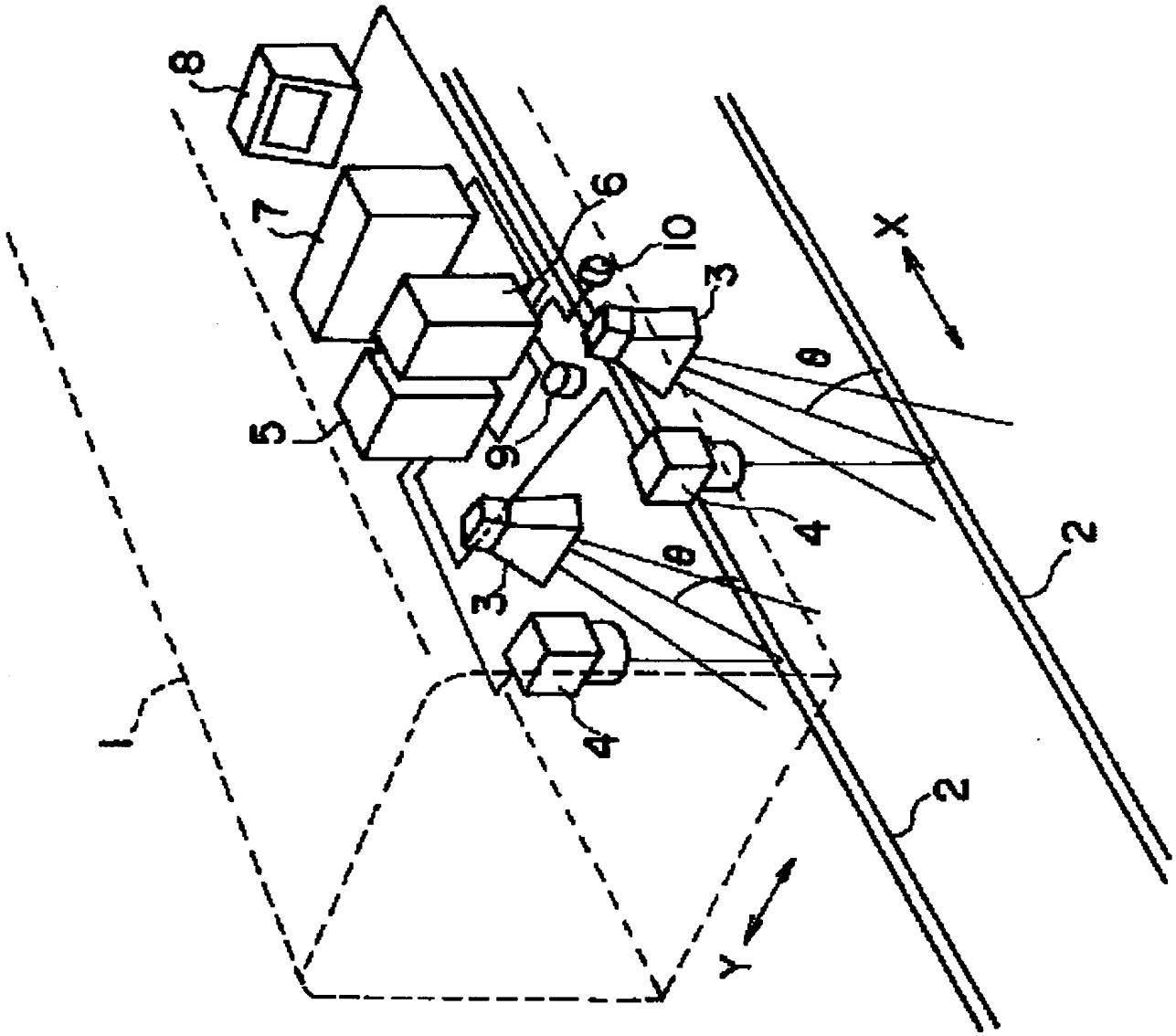
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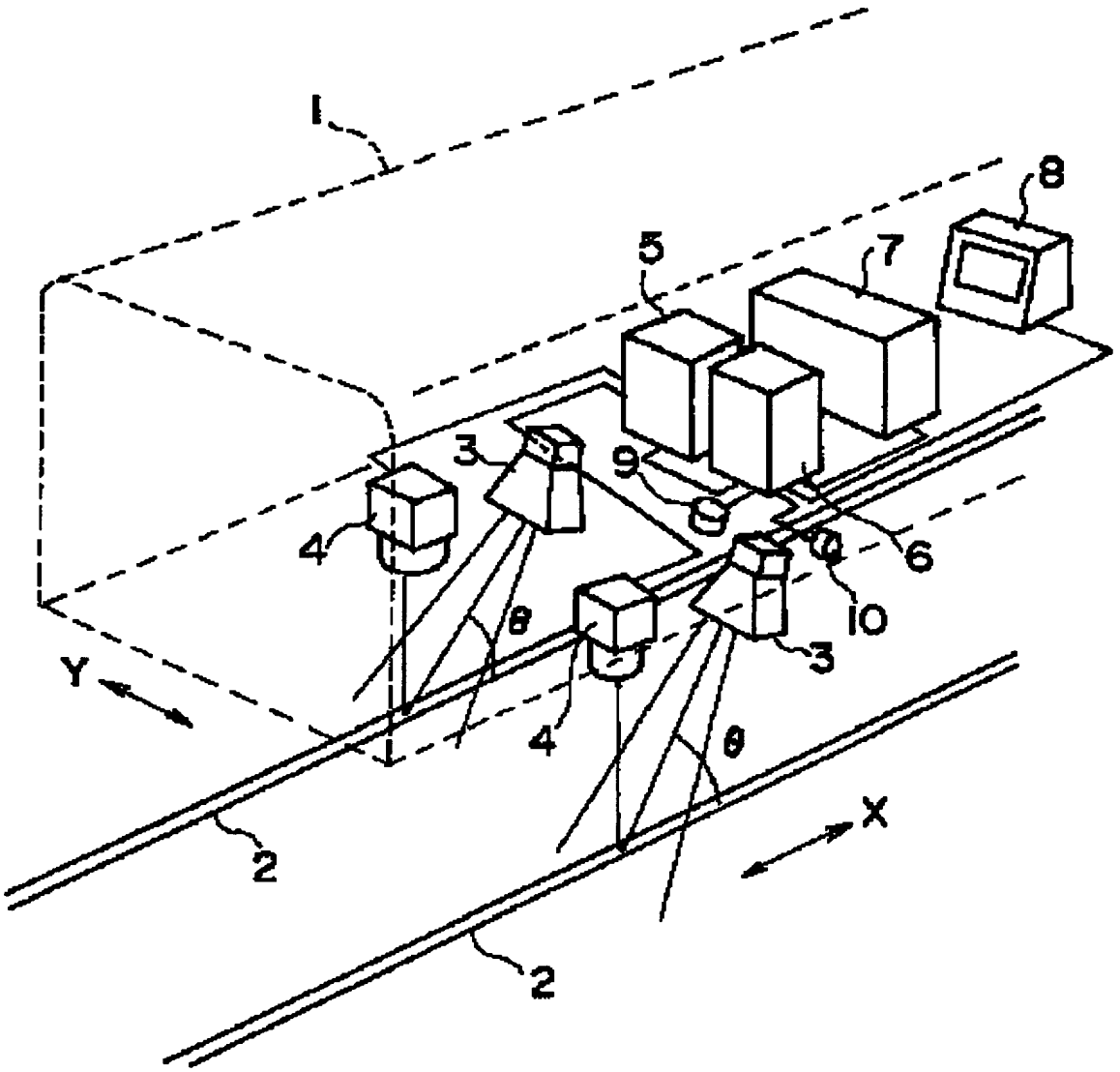
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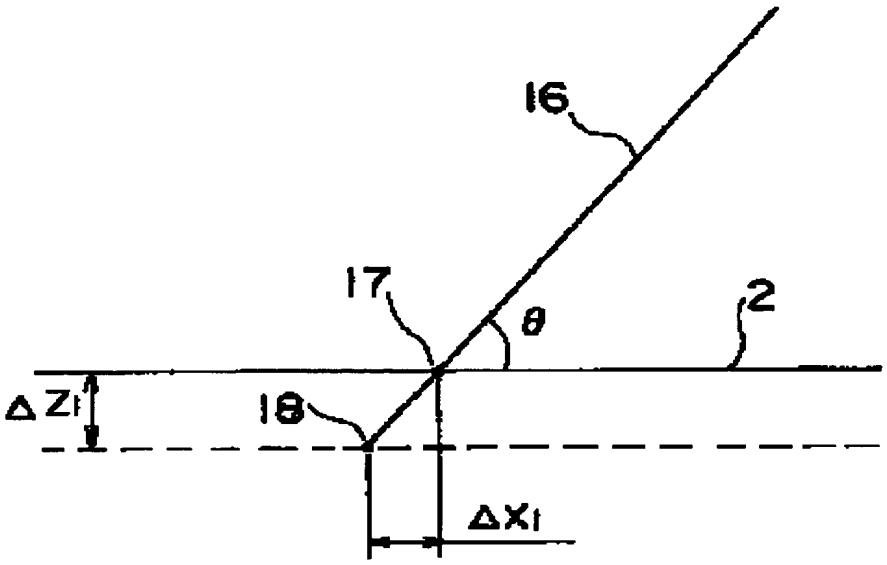
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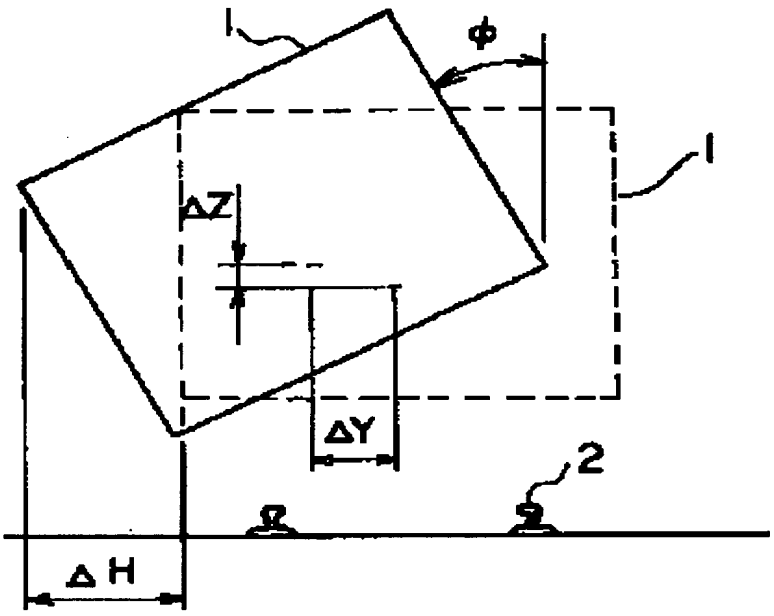
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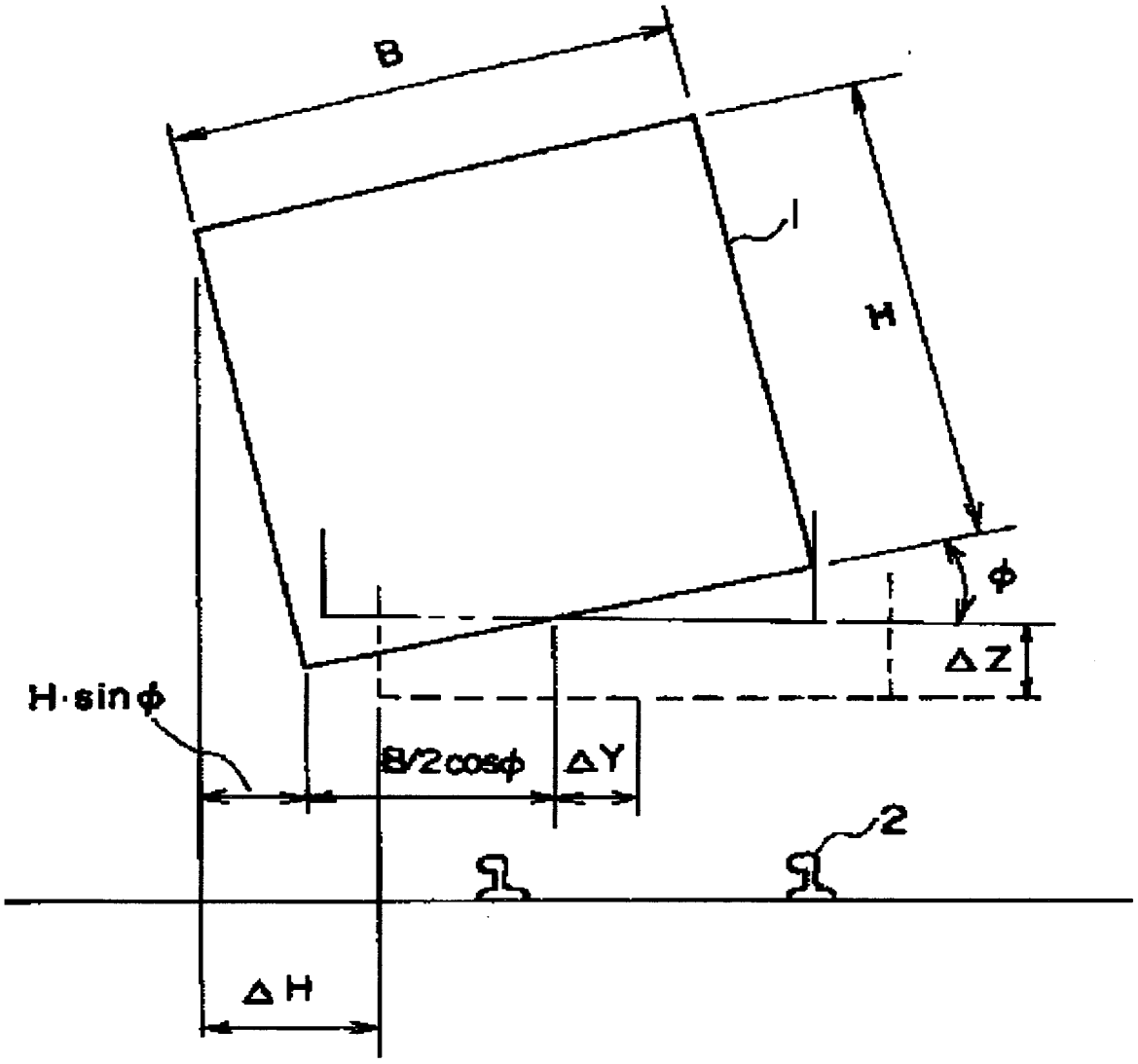
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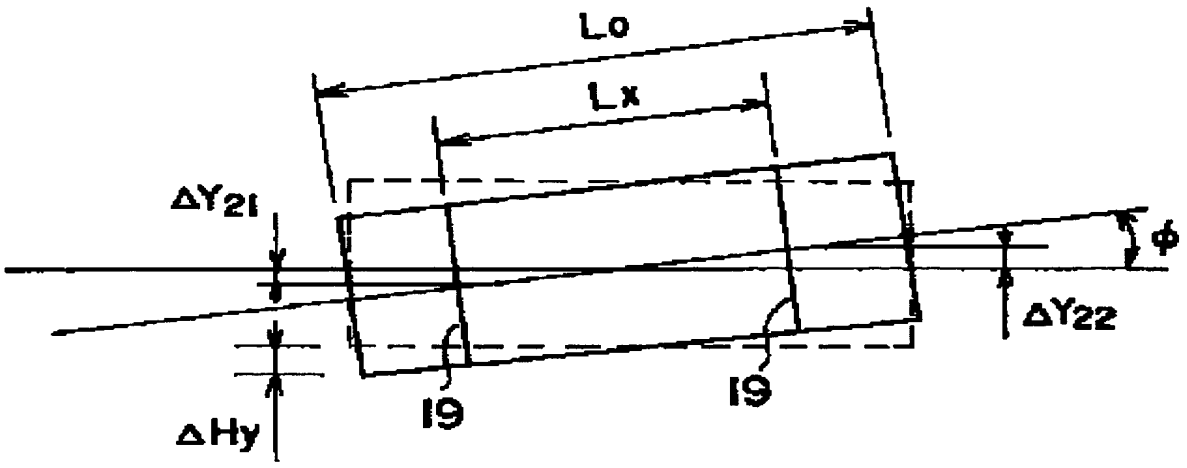
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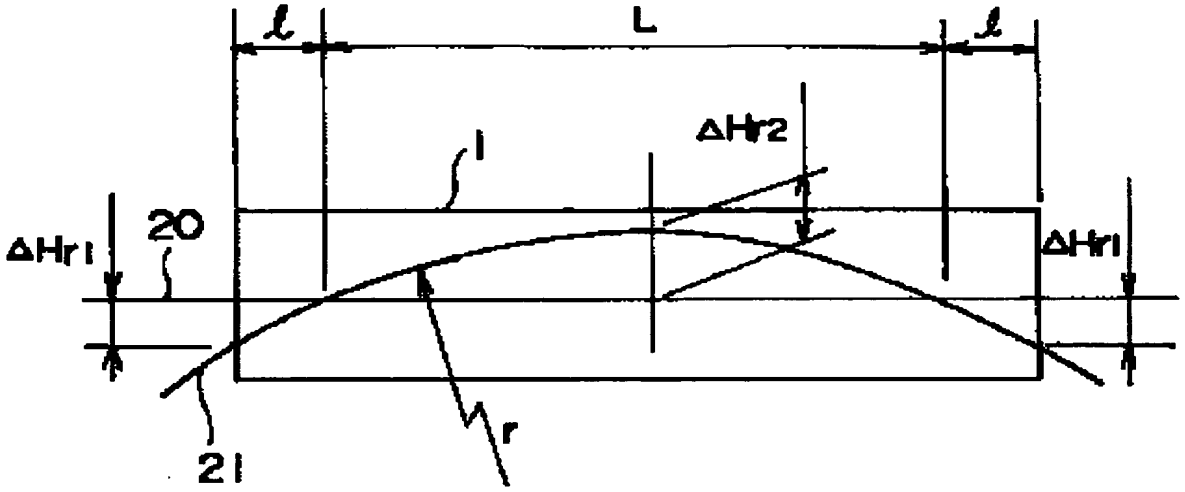
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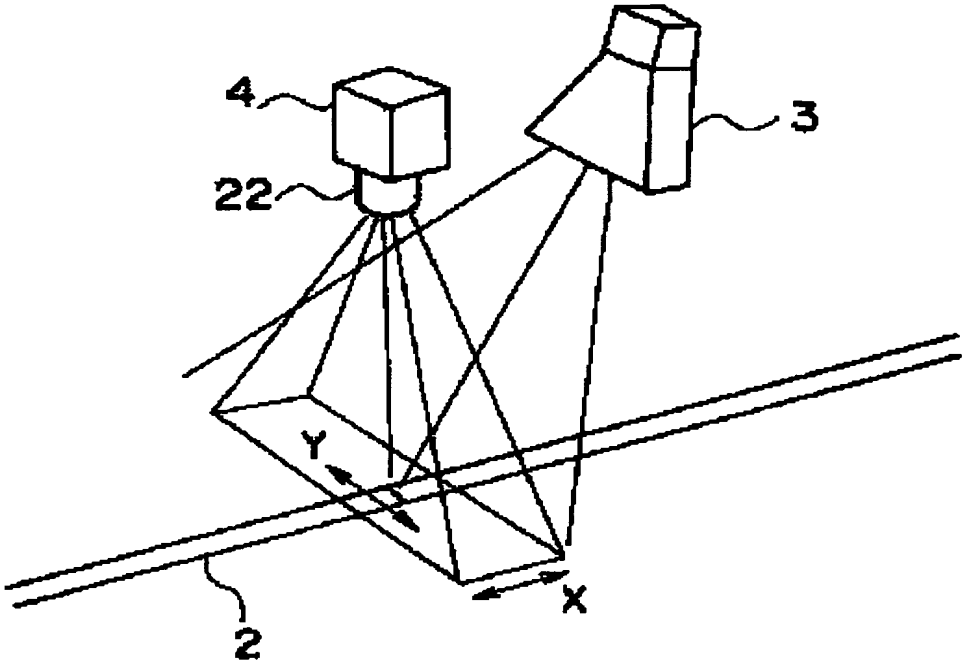
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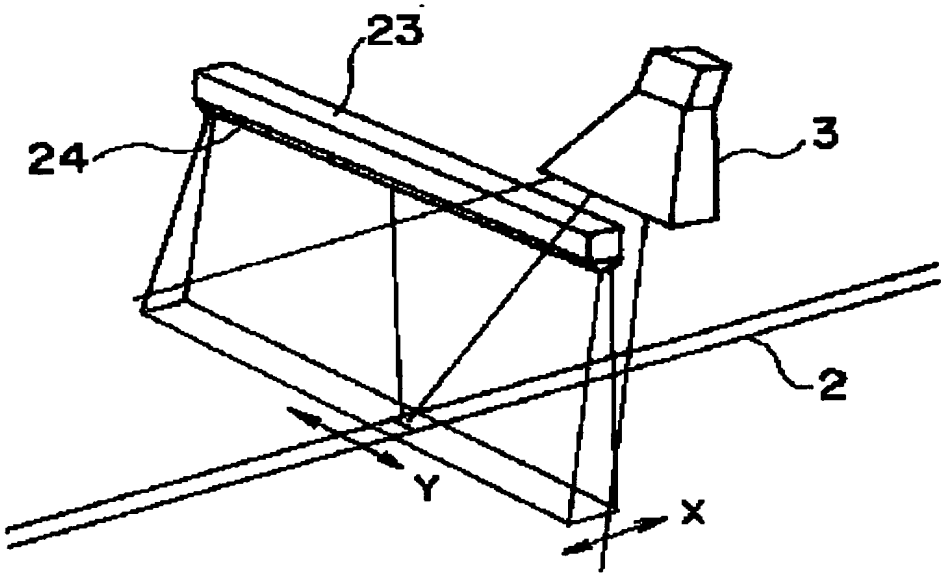
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